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Wind power deployment outcomes: How can we account for the differences?

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Abstract

This paper aims to understand different outcomes of implementation of wind power deployment programmes. Geographical variables such as quantity of wind resources are in themselves insufficient to explain patterns of implementation of wind power. To enhance the review of the factors affecting wind power deployment we also made a systematic comparison of six country cases: Denmark, Spain, Germany, Scotland, the Netherlands, and England/Wales. The impact of four key institutional variables is examined and put into a scheme of a set of potential hypothesis about their inter-relationships. These are influenced by different national traditions: planning systems; financial support mechanisms; landscape protection organisations and patterns of ownership of wind power. (1) Planning systems, which favour wind power are essential, and in all cases national planning policies generally intend to support wind power development, but planning institutions show a wide variety with clear differences in implementation results. (2) Systems of financial support are also a sine qua non for development but they also vary in their effectiveness across country and time in the study. Robust and consistent support regimes in Denmark, Germany and Spain have speeded developments. (3) Landscape protection organisations vary in strength in a range between England/Wales (very strong and influential) to Spain (non-existent). Strong and effective opposition to wind developments is always primarily rooted in landscape values. (4) Local ownership patterns coincide with higher rates of wind power deployment than remote, corporate ownership. Local

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involvement recruits conditional support for projects and is related to traditions of energy activism. Such traditions are strongest in Denmark and Germany and weakest in Spain, England/Wales and Scotland.

Keywords: Resource; Planning; Local ownership; Landscape; Financial support

Contents

1. Introduction

The expansion of renewable energy is widely recognised as an important element of the transition to a sustainable energy economy. There is considerable controversy over the involvement of wind power in this strategy. The aim of this paper is to understand how divergent wind power outcomes have occurred. We selected Denmark, Spain, Germany, Scotland, the Netherlands, and England/Wales, as empirical cases to compare the geographical differences in the outcomes of wind power implementation. These countries are leaders in European wind power deployment and these are cases where we have good levels of empirical material at our disposal. Our main focus is necessarily on onshore wind power since offshore wind is a different technology that is still in its infancy. At the end of 2004, it constituted less than 2% of the installed wind power capacity in these countries [1].

We acquit our aim by briefly explaining our historical institutionalist approach. Hall and Taylor [2, p. 938] define institutions as

> formal or informal procedures, routines, norms and conventions embedded in the organizational structure of the polity or political economy. They can range from the rules of a constitutional order or the standard operating procedures of a bureaucracy to the conventions governing trade union behaviour or bank–firm relations.

We apply this to wind power so that when we talk of institutions we mean decision-making structures, forms of organisation of wind power, planning systems and norms and agreements, which underpin wind power policy and practise. We compare different institutions in order to understand how these institutions are associated with different

outcomes and practices. The notion of 'path dependence' allows us to explain how current practices have emerged following policy outcomes in the past.

Historical institutionalism draws on the possibility that functionalist, political and cultural factors can all account for institutions evolving or changing [3]. Moreover, institutionalism draws attention to unintended consequences as well as inefficiencies generated by institutions. This is distinct from rational choice approaches that regard institutions as more purposive and efficient. Definitions of path dependence range from very broad ones to rather deterministic ones. Basically, path dependence perspectives reject the idea that the same forces will result in the same results in different places at different times [2]. Path dependency involves the notion that although there is room for agency and choice, once a developmental path is started, the alternatives that were once viable, become less viable, as actors adapt their strategies in line with the prevailing pattern [3]. Hence, options available at a given point in time, are partly in function of capabilities that were adopted in some earlier period [4].

Geographical factors, especially the quantity of wind power resources in a given country, will be very influential if we are making international comparisons of wind power outcomes. Hence we must try to picture the impact of this factor. We can then attempt to analyse other influences by investigating the effects of relevant institutions. Potentially influential 'formal or informal procedures, routines, norms and conventions' needed to be identified. The central purpose of this article is to derive and discuss potential hypotheses. Our suggestions for relevant institutions are hypotheses, which can then be examined and analysed with regard to the nature and effect of their influence on wind power planning outcomes. This gives the opportunity to other research programmes to test, and refine, these hypotheses in other case studies.

Having conducted a review of wind power planning literature we identify four types of institutional variables likely to have an impact on wind power deployment outcomes. These are the planning rules themselves, the financial support mechanisms organised by the state, organisations concerned with landscape protection, and ownership patterns of windfarms. It needs to be emphasised that what is important about these institutions is not merely their legal or formal rules but also the world views and notions of self interest that they carry with them or underpin their existence and operation.

2. Methodology

A vast resource of literature has emerged dealing with the assessment of the institutional factors affecting wind power implementation. However, this mainly concerns case studies. In order to enhance the review a more systematic comparison of six country cases is carried out. We treat the institutions as a set of potential independent variables that act together to influence the outcome. In the comparison of cases, the outcome is the quantity of wind power (electricity) supplied in a particular country. This is the dependent variable. Then we analyse the independent variables. First, we analyse a major geographical variable, notably wind resources in each country-case study. Then we shall move onto institutional variables. We analyse how each of the variables is configured, and we make an assessment of how they may influence outcomes in the six country-cases. Our selection of cases is based partly on a need to focus on those countries who have had dedicated support systems for wind power since the early 1990s, and also, to some extent, on the resources available to the researchers in this study. Scotland is treated as a separate country because

some key conditions in Scotland are different to south of the border. Our assessments are based on previous and ongoing research projects and we use data from secondary literature, existing case studies, policy documents, and we also refer to some selected interviews with stakeholders in policy domains relevant for wind power [5–20].

We stress that we use this approach as a way of framing the problem rather than laying claims to undertake a quantitative assessment. In adopting such an approach we recognise that we have no statistical method of weighting the impact of each variable. Our aim is analytical, not statistical generalisation [21], and if we are to develop explanations of differential rates of wind power deployment in different countries then we see no alternative to utilising an approach with interpretive dimensions. For example, we know that the impact of scenic values is the main determinant of individual attitudes to wind power [22,23]. However, no study in attitudes towards wind power's effect on the landscape compares those effects in the different countries. Moreover, scenic values are highly subjective and there is a lack of adequately designed quantitative studies of such issues [24]. Proxy methods, for example, discussing the nature of landscape protection groups in each country are possible and useful, although in this case we cannot be sure about whether the relative strength of such groups is merely an effect of the interaction of other variables which brings hostility or acceptance of wind power to the fore. Different cultures interpret the interaction between technology, environment and decision-making differently [25].

3. Geography: wind resources

3.1. Implementation potential

The quantity of wind resources is a vitally important influence on the size of a nation's wind power programme. We shall discuss this before moving on to compare the wind resources in the different countries with the amount of actual deployment of wind power. We set out a comparison of onshore wind resources in Table 1.

The only available comparative account of EU wind resources [26] involves conservative criteria, such as inclusion of technical constraints, as witnessed by the fact that German wind production in 2005 was already higher than the level said to be the technical onshore

Table 1
Relative onshore wind resources in the country-case studies

Country	TWh[a] per year wind electricity production potential
Denmark	26
Spain	86
Germany	24
Scotland	54
The Netherlands	7
England and Wales	52

Based on [26, p. 21], with no breakdown of the UK (114 TWh including Northern Ireland). The proportion between England/Wales and Scotland is based on comparisons between quantities of areas in different wind speed bands as indicated in [27, pp. 38–39].

[a]TeraWatt-hour: 10^{12} W-h of energy.

potential. Nevertheless, the significance of the data in Table 1 in the context of this study is that of a comparison of the relative wind resources of each country. To distinguish between Scotland and England/Wales, we had to derive such a division independently (Table 1, note).

The next step is to compare this wind resource with the amount of wind electricity being generated (in a typical year) from wind turbines in place in each country at the end of 2005. Fig. 1 shows the quantity of electricity that is supplied by wind power, which is the dependent variable, which may be partially explained by the wind resource potential.

It may also be useful to state the percentages of electricity that are being supplied by wind power in each country (on an annual basis). One analysis produces the following percentages: Denmark (20%), Spain (8%), Germany (6.7%) and the Netherlands (2.5%). England/Wales comes to just 0.5% and Scotland 5% of electricity consumed (see notes to Fig. 1).

Fig. 1 shows that implementation rates are explained to a limited degree by geographical potential. Both Denmark and Spain have relatively good wind resources and also relatively high quantities of electricity generated from wind power. Yet, on the other hand, England/Wales and Scotland have big wind resources yet relatively meagre wind power deployment. Perhaps the biggest discrepancy is that England/Wales and also Scotland have less wind power electricity supplied compared to Germany, the Netherlands, or Denmark, despite having much better wind resources. Germany seems to have an especially large amount of wind power compared to its wind resources. Now we arrive at our key question: how can we account for these differences and anomalies?

One strategy is to argue that the more densely populated a region is, the more spatial claims will exist and the more conflicting land uses may emerge, which will also affect the possibilities that people will object to the schemes. This may be a factor in places like the Netherlands where population density is especially high. Also, Scotland is less densely populated compared to England/Wales. However, it may be that in some cases areas of low population densities value is placed on them precisely because they are valued for

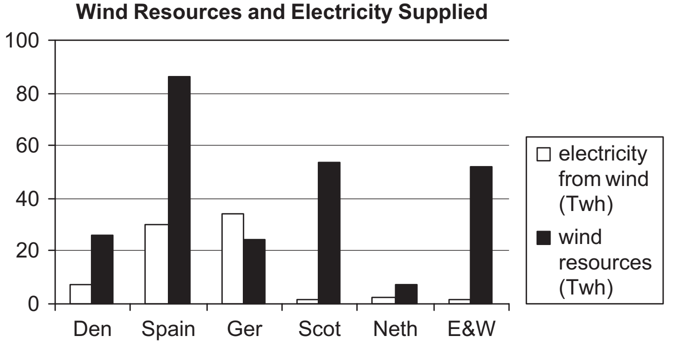


Fig. 1. Annual quantity of electricity supply from wind (based on end-2005 installed wind turbine capacity) compared with wind resources (annual potential production). *Note*: TeraWatt-hour: 10^{12} W-h of energy. *Sources*: Wind Energy Statistics World Wide http://home.pi.net/~windsh/stats.html (accessed 30 April 2006); British data derived from http://www.bwea.com (accessed 30 April 2006). The 'Wind Energy Statistics World Wide' database uses end-of-2005 installed wind turbine generation capacity figures to compute what wind electricity outputs would be in a year of average wind speeds for each country (average wind speeds vary from year to year).

being 'rural'. It is very difficult to unscramble these counter-veiling tendencies. There are some other, institutional, candidates for influence. In the following sections, we use the variation in Fig. 1 and try to explain it with the selected salient variables.

4. Planning practices and systems

We begin this section with the task of comparing wind power planning outcomes. We shall then discuss different planning frameworks in the country-case studies and finish this section with some general comments about the impact of different wind power planning systems.

Because the planning systems in our countries vary, it is difficult to produce comparable data on wind power planning outcomes. For instance, we could look at the positive outcomes of permitting procedures. Interviews with a range of actors in the wind industries in the case studies reveal that it is easier to gain planning consent in Spain rather than in the Netherlands and much of England/Wales and Scotland. There are some statistics to support this. Around 60% of all wind power planning applications are rejected by local councils in England/Wales [28]. Scotland, on the other hand, has enjoyed a high local planning acceptance rate of around 75%. However this proportion is declining.

In Spain, around one in five applications receives significant opposition from local wildlife conservation groups, and these can be subject to considerable delays. However, even these cases tend to result in more money being paid for local projects rather than municipal rejection of the schemes. In only some rare cases have municipalities simply refused to allow wind farms to be built [5–8].

In the Netherlands about 80% of the proposed wind power developments are not given planning consent [29], but most of these failures occurs at an informal level. When it becomes apparent that proposals will fall foul of legal objections, formal procedures are mostly not started [9,30].

The high levels of deployment of wind power in Denmark and Germany suggest that overall planning consent levels for wind power schemes has been relatively high. However, this general level of success may hide the influence of patterns of ownership, a factor that will be discussed later.

The rate of success within the permitting procedures only tells us part of the difficulties faced in local decision-making, since in some countries many serious wind power schemes never officially reach the procedural stage, whereas in other countries almost all schemes do. We therefore compare the formal planning policies for wind power in the different country-case studies.

In Germany (since 1997), local councils are required by national laws to designate suitable areas for wind development. However, implementation of this has been patchy. For instance, by the end of 2001, only half of the municipalities in the German state of North Rhine Westphalia had designated areas for wind power development [31]. While some municipalities regard this requirement as a top-down measure that limits their discretion, project developers are very satisfied with this German '*Priviligierung*' (preferential treatment). Moreover, where municipalities have not indicated areas, developers are in principle free to develop a wind scheme anywhere outside the build-up area, as long as they respect designated areas. Since the *Priviligierung* opposition seems to be rising. Many think of it as a rather top-down planning measure that grants too much privilege to wind power (compared with e.g. other renewables).

In Spain, planning for specific schemes is the preserve of the regional governments. The planning permits are issued by the Regional Governments who sometimes take the lead in setting up competitions for wind power contracts [6,32]. The municipalities are also required to give consent, but they only have weak legal powers to refuse planning permission, and they rarely attempt to completely thwart wind power development. When there are disputes with local interests consent for development is achieved after the developers agree to give money for local purposes out of project income. Hence, whilst there may be delays, this only rarely leads to permanent rejection [6,33, p. 296]. In Spain, the key decisions about making space for building turbines (zoning, building permits, environmental permits) is at the Regional level. This is in contrast to the other cases where they are (except in the case of large schemes in the UK) taken at the local council level.

By contrast, in the Netherlands, wind power schemes require pro-active decisions from municipalities [34]. The zoning scheme has to be changed, or another municipal decision must be taken to get around this. Municipalities can simply refuse to take such decisions needed to allow consent for wind power schemes. Several proposals to grant central government directive powers to force wind power development have so far not been adopted, because they are out of line with the Dutch administrative consensus culture [35].

Planning policy guidance in force on the UK since 1993 has exhorted local authorities to adopt a ‘presumption in favour’ of wind power development. This presumption has been emphasised and further clarified by a planning policy statement issued by the Government in 2004. Yet, this does not prevent a large proportion of wind power planning applications being rejected by local councils. On the other hand, developers can appeal to the central Government against planning refusal, and in around a third of such cases these appeals are successful. The larger schemes are dealt with directly by central government with local authorities acting in only an advisory manner. This represents a rather larger central discretion than exists in other countries and this provides a balance against some local opposition to wind power schemes.

In Denmark (since 1994), local municipalities have been obliged to allocate zones for wind power development. Only 10% of municipalities refused to follow this directive [10]. Denmark is distinctive for having the highest proportion of electricity supplied by wind power, but it is also distinctive because it is the only country-case where municipalities have been obliged to involve counties (regional authorities), local non-governmental organisations and utilities early in the planning phase. Elsewhere political institutions generally do not support local collaborative practices and provide little opportunity for participation that goes beyond formal consultation on ready plans [36,37].

Wind farm developments call for a planning system which addresses the obvious dilemma between the promotion of wind power by the national governments, and the various political structures of the regional/local planning system that allows for citizen participation [38, p. 567]. Notwithstanding the importance of collaborative planning, once there are groups fundamentally opposed a wind scheme, it will be of little help. Especially when local authorities are not positive towards wind power development, oppositional groups have much influence—we shall discuss the origins of such opposition in the next section. The nature of local networks constitutes an important institutional variable affecting the fate of wind farm planning applications. In England/Wales and Denmark the nature of the local activist networks appeared largely responsible for the outcome of planning applications [39]. Important aspects of these networks are not only those

opposing wind farm developments, but also whether there are significant local networks supporting wind farm developments.

Our main reason to study the institutional constraints to implementation is that a growing number of studies show that achieving positive local decision-making on wind power schemes is an uphill battle. This does not mean that local populations are generally opposed to wind power. Public attitudes to wind power are generally positive [24,40–42], but a clear distinction must be made between general attitudes towards wind power and the behaviours towards specific wind power schemes. It is the interplay of local interests and local planning institutions, which determine decisions not the mere existence of some negative attitudes as such. This setting is only partly shaped by the centrally organised wind power planning policies.

Planning and siting are different things [43] but governments of all selected countries have discussed the fashioning of planning practices to facilitate the siting of wind power developments. Such interference has been effective in some cases, especially in Germany, Denmark and Spain. The acceptance or rejection of proposals for wind farm schemes is a largely a consequence of local interests and issues, as has been established in England/Wales and the Netherlands [28,34].

When investors come from outside the community or when higher tiers of government try to site wind power facilities without involving local communities, they may easily create mistrust and the process can be perceived as unfair [23,44]. It has been argued that developers will have greater success if they involve the local community (the public, as well as stakeholders) in decisions [45,46]. In such collaborative approaches visualisations as a key element can be used as an important instrument to elucidate potential conflicts between proponents and opponents in advance, as they greatly facilitate the discussion [47]. However, developers often take public support for granted too easily, to be subsequently confronted with public resistance to the blatant placement of turbines in the landscape [42,48].

5. Landscape protection organisations

Although collaborative approaches to planning may be a remedy for emerging opposition due to lack of trust in investors and authorities, and authoritarian ways of planning, they cannot guarantee success. Opposition that is based on the fundamental rejection of wind power as an acceptable energy source will not be persuaded. If such negative attitudes exist, they are rooted primarily in values of landscape protection. Studies that try to establish the significance of arguments that inform general attitudes, show that visual impact and landscape intrusion are by far the most important factor [22,23]. Other factors of environmental impact, such as noise annoyance, or impact on wildlife particularly birds, etc. may become significant depending on the location. However, even when we look at a factor such as annoyance from wind turbines sound, it is still more strongly related to visual impact attitudes than to sound pressure [49].

There is no survey that compares attitudes to the impact of wind power on the landscape in different countries. However, it is possible to compare the impact of landscape attitudes on implementation by using the proxy of looking at the strength of organisations that are dedicated to landscape protection. It is necessary to differentiate between landscape or nature protection groups that are generally sceptical of wind power, and groups that are specifically established to oppose wind power developments.

Concern for landscape (or lack of it) in cases of wind turbine siting includes coastlines and near-shore sites for wind turbines [42,50]. It arises from path-dependent cultural conditions. In England, for example, the countryside is part of the national identity [51], and long battles have been fought against the industrialisation of the countryside in a tradition that stretches back to romantic poets of the early 19th century. England (and our case Scotland as well) has strong groups that have landscape protection as a key priority. These include the Campaign to Protect Rural England (CPRE), which is sceptical of wind power, and the Campaign to Protect Rural Wales (CPRW), which now opposes wind power planning applications as a matter of strategy. There are also groups specifically dedicated to campaigning against wind power development, at local as well as national level.

By contrast, Spain has no national organisation opposed to wind power, and there is little activity to protect Spanish landscapes. Preference studies reveal that impact of wind farms on flora and fauna or specific local impact on geologically rare cliff sites is valued more than landscape values as such [52]. Rural areas in Spain are poor and subject to depopulation. There appears to be little value placed on living in rural areas in Spain, in contrast to the prevailing position in England.

The other country cases (Denmark, Germany, the Netherlands) fall somewhere in between the Spanish and British cases. All three country-cases have citizen groups opposing wind power project. However organisations set up to protect environmental resources tend to be oriented primarily towards protection of nature rather than landscape. In contrast to the British cases, these organisations tend to be generally supportive of wind power. Local branches sometimes campaign vociferously against proposals that may seriously affect local landscape characteristics. In Germany there has been an increase in concern about wind power's impact on the landscape in the last 5 years. In earlier years, nature protection groups promoted wind power following on from a tradition of campaigning against coal and nuclear industries.

It is possible to view landscape value as an economic resource, valued either as a living space or tourist resource, which can compete with wind power as a land use. Regions which are perceived as being in economic decline or which are not highly valued as living spaces are therefore less likely to resist wind power development [53].

6. Renewable energy procurement regimes

6.1. Financial procurement

The financial incentive regimes for wind power are still a sine qua non for large-scale wind power deployment since wind power usually costs more than fossil fuels. However, the terms and rates available vary among regimes, and different types of incentive regime seem to have different effects on wind farm deployment. All of our countries cases have had procurement regimes since about 1990, sometimes offering direct subsidies to investments, sometimes providing financial in proportion to the amount of electricity generated. Denmark has been the most longstanding incentive regime for wind power, owing its genesis to the early 1980s, although the onshore incentive programme was mostly terminated at the end of 2001.

There has been a debate over the efficacy of 'market-based' procurement regimes. The two basic types are market-based schemes which (in theory at least) involve some element

of competition between projects designed to bring down the price of wind power, and 'feed-in' tariffs which involve the provision of fixed prices paid for a given amount of electricity from wind power schemes. The most prominent success case is Germany, that has 'feed-in' tariffs since 1991, about the time as their rapid development started. Spain has also experienced a high deployment rate in recent years, also applying a consistent policy for a feed-in tariff. In England/Wales, Scotland and the Netherlands 'market based' schemes of different types have been used, for example based on tax rebates or tradable green electricity certificates. However, it is unclear as to whether the market-based schemes are any more cost effective or whether they even promote different types of scheme, in particular corporate owned rather than locally owned [54,55]. Both types of scheme have strengths and weaknesses and ultimately involve subsidy in one guise or another [56].

What is clear is that wind power capacity will proliferate only where incentive regimes are stable and deliver a substantial level of subsidy. The Dutch competitive fiscal support scheme for renewables that was introduced from 1996 onwards, was partly abandoned in 2002. It malfunctioned, because it mainly supported biomass (and waste incineration) in old environmentally unsound power stations abroad. The expansion of the domestic generation capacity remained limited [57]. It was replaced with a limited feed-in tariff combined with a decreased ecotax exemption. The accelerated increase of installed capacity over the past few years—compared to earlier years—suggests that even this limited feed-in tariff has triggered implementation [35]. Furthermore, countries like the Netherlands and also England/Wales and Scotland, show a strong variation of policy instruments. The reliability and consistency of the procurement system, and the obvious will to sustain it for a long period (stability of support systems) should be considered a major factor in investment decisions. Changes every few years, as was the case in the Netherlands, undermine the perceived reliability, whereas the German Government has actively defended its feed-in tariffs against appeals in court and the foundation of their system stands for over a decade now. However, the German feed-in tariff has come under increasing attack in recent years. Support levels have been cut.

While large German electricity companies like EON and RWE are fiercely opposed to the feed-in support for wind power in Germany and have few investments in wind power, these same companies are supportive of the UK's Renewables Obligation (RO) which operates in both E&W and Scotland. They are developing an extensive portfolio of investments in England/Wales. In Denmark where onshore wind power has been deployed mostly by local actors, the electricity utilities were also critical of the costs of the wind power support system. The developments in Denmark have almost ceased after the termination of the support, because of widespread uncertainty among potential investors about the conditions for introduction of green certificates [58].

The choice of a 'market-based' system in the UK, where prices paid for wind electricity are decided through market competition rather than being set by law, is associated with a dominant wish in government for schemes that involve competition [14]. There were implementation problems with the first version of this procurement system because it involved competitive tendering, and developers underbid each other to such an extent that the resultant schemes were often uneconomic [59]. Moreover, the Scottish section of the UK's renewable energy programme was later in starting compared to England/Wales, which may have delayed the exploitation of Scottish wind power potential. The Blair Government has continued this neo-liberal legacy of a 'Thatcherite' approach to public service administration. The second version of the UK's renewable energy programme, the

RO, launched in 2002, has been associated with giving good levels of incentives for onshore wind power. This has resulted in a great increase in the volume of projected wind power schemes. However, the RO has been criticised for being an expensive means of promoting renewable energy expansion [54].

Incentives should preferably be based on energy yield rather than on capital investment, as the latter do not reward the best performing turbines and sites. Instruments should encourage production of electricity rather than investment in renewable energy capital [60, p. 95]. The overview of financial support systems operating in the different case studies (Table 2) suggests that whatever their other faults, fixed price wind power regimes have the benefit of simplicity and they offer secure, predictable, returns as long as they are sustained for a long time. When rules and regimes are sustained, they provide stability by guiding perceptions and actions [61]. Systems that pretend to be 'market based', are often regimes that offer less predictable returns, and moreover, there seems to be a good measure of controversy about what their optimum design rules should be.

6.2. Patterns of ownership of wind power

In the patterns of ownership of wind power there is a contrast between Spain, Scotland and England/Wales on one hand, where the wind industries are dominated by corporate players, and on the other hand Germany, Denmark and the Netherlands, where there is a high proportion of local ownership (Fig. 2).

The term 'corporate' (Fig. 2) covers a range of non-local types of ownership including traditional utilities, independent power producers, and other hybrids. We use the term

Table 2
Institutional variables: economic

	Denmark	Spain	Germany	Scotland	The Netherlands	England/ Wales
Financial procurement system (main type)	Feed in tariff	Feed in tariff	Feed in tariff	Competitive tendering, green certificates,	Subsidies; tax, green certificates; feed in tariff	Competitive tendering, green certificates,
Stability of financial procurement system	Stable (until 2001)	Stable	Stable	Varying/ unstable	Unstable	Varying/ unstable
Economic involvement	Local/ private ownership	Power comp.	Local/ private ownership	Power comp.	Power comp./ growing local/ private	Power comp.
Grassroots initiatives (historical roots)	Local community/ anti nuclear	Rare	Anti-nuclear/ Greens	Some local anti-windfarm groups, few pro-windfarm	Anti-nuclear	Many local anti-windfarm groups, few pro-windfarm
Grassroots (related to dom. politics)	Supported	Usually not active	Supported	Alienated	Alienated	Alienated

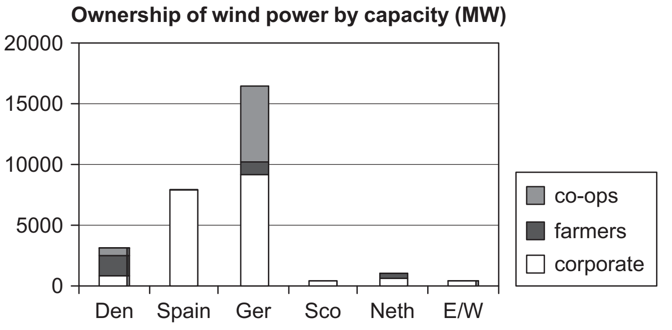


Fig. 2. Patterns of ownership of wind power. *Source*: Interviews [6,16,19,20], and 〈www.bwea.com〉. *Note*: The Danish statistics include offshore wind installations constituting around 14% of installed capacity, most of which is owned by (corporate) utilities. Danish onshore wind power owned by the corporate sector constitutes 12% of all wind power capacity.

'co-operative' to mean schemes that are participative and locally based or run for non-profit, 'ethical investment' purposes. In Germany the corporate sector is especially hybrid in nature since it mainly consists of medium-sized companies financed by public share offers to high income earners. Most of the rest of German wind power capacity is owned by farmers or '*Bürgerwindparks*' ('Citizens' wind farms'). These latter schemes are citizen–investor-owned schemes with strong local participation. These also involve ethical investment principles emerging from the grassroots movement, and they sometimes offer lower returns.

Local ownership may counteract some of the objections to wind power schemes raised on landscape grounds. Enthusiastic farmers can deploy their local contacts to reduce the scale of planning controversies compared to outside utility or corporate-funded developers. Loring [39] has analysed the use of local social networks to increase the likelihood of winning planning consent. Hence, locally inspired and locally owned projects can help improve the prospects of schemes being given planning consent and, arguably, also improve the general planning environment for wind power. It is plausible to argue that the lack of farmer and co-operative ownership in England/Wales has significantly exacerbated planning controversies. In Denmark and Germany various sources attest to the higher rate of planning acceptance for locally owned projects [15,62,63]. A Danish Government report commented:

> The local environmental disadvantages of wind power can lead to a lack of public acceptance of wind farms. Local ownership of wind turbines (local farmers, co-operatives or companies) can ensure local acceptance of projects [64, p. 7].

Co-operatives involve large numbers of people investing in wind power, hence enlarging the pro-wind power lobby at a both local and national level. It seems that the public-participative style of ownership that has been typical of much German wind developments (including the corporate sector) has improved the political profile of wind power [37].

> What happened after the Electricity Feed-in Law is that many individuals have invested in local wind power schemes, and these people have become 'energy experts',

> so people are much more aware about wind energy. Now everybody is aware that electricity doesn't just come out of a plug. Because there are thousands of investors in wind energy there is a strong lobby for good conditions for wind energy in the future [16].

There seems to be a strong association between high levels of farmer ownership and significant levels of co-operative activity in the wind power industry. In Denmark, Germany and the Netherlands there is a significant level of co-operative activity and a large level of commercially oriented farmer ownership of wind power. However, in England/Wales, Spain and Scotland there are very low levels of farmer and co-operative ownership. In Spain this is compensated by successful investments of energy companies that seem to flourish in the regional economic planning and development regime. The patterns of ownership seems likely to be related to another example of path dependence; in those countries with local ownership there has been a tradition of local energy activism, compared to relative in-activism at the local level on energy matters in England/Wales, Spain and Scotland.

In Germany, Denmark and the Netherlands a tradition of locally, populist-based energy activism connected to the anti-nuclear movement sprung up in the 1970s and 1980s. In the Netherlands, several mass demonstrations were held against nuclear power in the late 1970s. A movement for alternative energy grew out of this activity [65, pp. 156–161]. The founders of the Dutch cooperatives have a background in the anti-nuclear movement. They were environmentally and ideologically inspired, and belonged to a network of self-builders and pioneers. In Germany, the 'citizens' initiative' movement began in the 1970s as local action groups pressing for local, often environmental, causes, but as the 1970s and early 1980s such movements became increasingly concerned with anti-nuclear politics [66, pp. 102–104]. This anti-nuclear activism greatly encouraged interest in alternative energy. A very similar pattern can be seen in Denmark where a militant anti-nuclear movement grew up in the 1970s, which attracted 30,000 members at its height out of a population of only 5 million. This was paralleled by the development of a mass-based, populist movement for alternative energy in the shape of the Organisation for Renewable Energy [65, pp. 95–109]. Indeed it is from this movement that the modern wind power industry largely stems.

By contrast the anti-nuclear protests in the England/Wales, Spain and Scotland were relatively less strident compared to Germany and Denmark. In these latter countries there were many mass demonstrations. In Germany, where there still is nuclear power (there is none in Denmark) there have been recent mass demonstrations and sometimes violent confrontations with police. Although the UK boasted a developed network of environmental Non-Government Organisations in the 1970s and 1980s activism against nuclear power was mostly restricted to writing letters to public inquiries [67]. There are few locally owned (commercially sized) renewable energy projects in England/Wales or Scotland. There are some exceptions to this rule. However, it has been argued that these exceptions demonstrate that there are financial possibilities for local ownership and that it is lack of effort that is the reason for the relative scarcity of local ownership of wind power in the UK [54,68]. Environmental NGOs were very weak in Spain in the 1970s and 1980s, partly because at the time environmentalism emerged in industrialised countries Spain was still a dictatorship in which environmental groups were suppressed [69]. After Franco died, the main concern was to establish democracy and to modernise the economy, with relatively low attention to environmental issues.

It should also be noted, however, that grass roots movements have often been at loggerheads with the conventional electricity industry. The Dutch grass roots and other independent developers on the one hand and the power companies on the other hand were not cooperating. The former saw their position undermined because the power companies received most of the subsidies until halfway the nineties. In Denmark, and especially Germany, the utilities have complained about the expense of the subsidy system. By contrast, in Spain and the UK (where wind power investment is dominated by corporate interests) the major power players have been generally supportive of the subsidy systems.

7. Summarising the institutional variables

Our aim in this review is to derive and discuss the institutional factors that influence wind power deployment outcomes, and we compared six country-cases in pursuit of that aim. The geographical potential, that is the amount of wind resources in proportion to the population, is the most obvious potential determinant of the amount of wind power likely to be deployed in a country. Beside this important factor, our analysis suggests that the influence of institutional variables is also crucial. Having discussed these various variables, we can summarise the elements that make them up, and the relationships between these elements. We have set out this in diagrammatic form Fig. 3. It shows the assessment of the effects of the institutional variables in terms of their influence on the siting and investment decisions. These factors eventually determine outcomes in the country-case studies that we have examined.

8. Conclusion

The level where the real decisions about investments and siting of concrete wind power schemes are taken is crucial. In most countries, this is the local level, except in Spain. The key question is how decision-making on that level is organised and how social networks, operating on either the same or other levels, are influencing those decisions. What are the impacts on these decisions of the four institutional variables: the planning regime; the financial support system; the value attached to landscape preservation; the degree of local ownership of wind power schemes?

Planning regimes that are positive towards wind power and supportive of wind power (or renewable) policy are necessities for successful wind power deployment programmes. We found that there are national planning regimes with positive intentions in all cases. Eventually the established systems of rules, competences and styles in planning practise do not always correspond with the positive intentions. In particular, when planning decisions are taken at a different governance level than the actual implementation, problems may arise. Correspondence between policy intentions and the outcome of the process at the implementation level increases when planning regimes invoke or support collaborative practices of decision-making. The problems that occur in implementing wind power are local in character and once a positive national framework has been established the degree of planning acceptance that is achieved is largely a function of the degree of local acceptance. Landscape-value-based fundamental opposition is unlikely to dissolve as a result of a collaborative approach. Collaborative approaches are helpful to avoid opposition from qualitative supporters, because project characteristics that may provoke resistance can be discussed and adapted. Moreover, such approaches are likely to

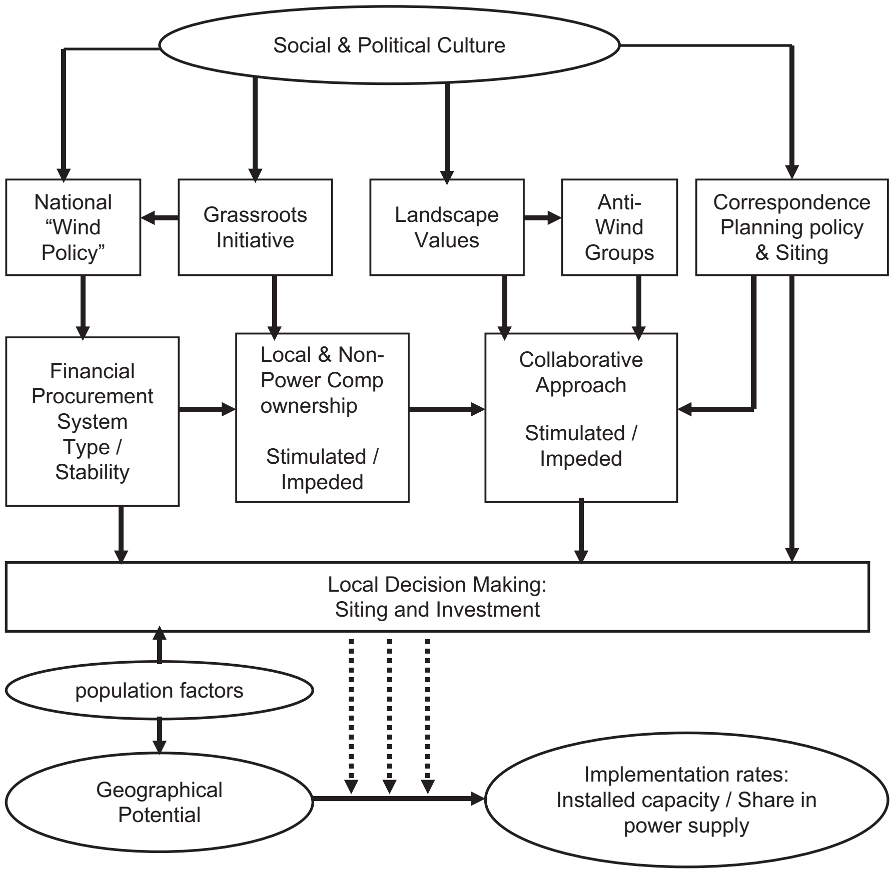


Fig. 3. Overview of institutional factors affecting the transfer of geographical potential into implementation.

create more local trust, particularly towards investors and authorities from outside the community. It is difficult for wind power to generate a major proportion of electricity supplies without a consistently high level of local tolerance for wind power. Such tolerance is undermined as the strength and number of local anti-wind farm groups increases.

The strength of anti-wind farm groups varies across time and country, and seems to be strongly related to attitudes to landscape protection in the different countries. Hence we discuss individual cases through this lens, which of country-specific landscape protection groups. Landscape protection organisations have been very weak in Spain, but relatively strong in England/Wales and Scotland. The other cases are intermediary, with the main nature protection organisations being principally concerned with nature protection rather than landscape. However in the most recent period landscape protection has become a bigger concern in Germany. It does seem that as the proportion of wind power increases there is a tendency for landscape issues to become more important. However there are wide differences in the levels at which this occurs in the different countries.

Just as a favourable national planning framework is essential for large-scale wind power deployment, so is a consistent system of generous, reliable subsidies. The objectives and the

unambiguous character of these support systems depends upon the social and political environment. Important elements in this environment include the ideological preferences that are dominant in countries and in their governments and also the institutionalised power of significant sectors such as energy companies. These factors affect incentive structures such as the design of financial procurement systems. Furthermore, these settings are also significant in the way that they affect the degree to which grassroots initiatives in wind power and renewables are anticipated and supported. The generosity and consistency of financial support systems have varied across the country-case studies. Denmark's financial support system was the earliest and remained generous and consistent until the end of 2001. This has allowed the high penetration of wind power in this country. Spain and Germany have had generous consistent subsidies for wind power since 1990, although German subsidies are being reduced at the moment. This has allowed a significant build-up of wind power in these countries, despite, in the case of Germany, a rather limited wind resource base.

On the other hand there has been a lack of consistency and generosity in support levels in the Netherlands, England and Wales and Scotland. The development of the Scottish wind resource has been delayed by being the last to be the subject of an effective financial support system. This is ironic in the light of its clear lead in terms of quantity of relative wind resources.

Negative attitudes as such are not a main impediment for wind power implementation, because those attitudes exist anywhere but hardly as a majority opinion. It is more important how negative attitudes are represented within the network at the decision-making level. Important aspects of these networks are not only those opposing wind farm developments, but also whether there are significant local networks supporting wind farm developments, for instance through locally owned schemes. There are some stark differences in patterns of ownership of wind power. Germany, Denmark and the Netherlands have significant levels of local ownership (whether by farmers or co-operatives), but local ownership is rare in England/Wales and Scotland and conspicuously absent in Spain. This does not appear to detract from wind power development in Spain since there are much fewer and, generally, weaker local anti-wind farm networks. However, the lack of pro-wind power local networks in England/Wales and Scotland may be associated with the lack of local ownership of wind power. This puts wind power development at a disadvantage given the extent of local opposition to wind farms based on landscape impact. The Netherlands is analogous to England/Wales and Scotland in that there is considerable opposition to giving planning consent to wind power schemes. Indeed the country has higher population density, yet its wind power deployment programme is buttressed by local ownership of schemes.

We can trace these different influences back to path-dependent factors. There is a historical tradition of strong institutions promoting the value of the landscape in England/Wales and Scotland, but an absence of such a tradition in Spain. There is a tradition, at least since the 1970s, of local energy activism in Germany, Denmark and the Netherlands, but much less of such a tradition in England/Wales, Scotland and Spain. Outcomes of wind power policy are path-dependent in the sense that outcomes are heavily dependent on long existing cultural dispositions towards landscape; on previous local political activity; and institutionalised (existing and past) preferences in the energy domain.

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